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British Columbia

FRASER RIVER ESTUARY MANAGEMENT PROGRAM

SUMMARY OF MONITORING AND RESEARCH ACTIVITIES

Standing Committee on the Fraser River
Estuary Water Quality Plan

September, 1987

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Fraser River Estuary Water Quality Plan

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ABSTRACT

The lower Fraser River and Estuary support large runs of salmon which are utilized in commercial, recreational and native food fisheries. In addition, the area is of major importance to migratory birds on the Pacific flyway and is extensively used for recreation. Industrial and municipal discharges, forest industry operations and agricultural activities affect water quality of the Fraser and may have an impact on its resources and recreational uses.

Mechanisms to address these concerns are described in this report. Included is a review of the Fraser River Estuary Study (FRES) which had been established to develop a management plan for the estuary. This was followed by the Fraser River Estuary Management Program (FREMP), which was established to help coordinate and improve decision making within the estuary. Through FREMP, a Standing Committee on the Fraser River Estuary Water Quality Plan was formed. The mandate of this committee is to develop a plan which will include water quality objectives, a coordinated monitoring program and document an acceptable arrangement for enforcement. The planned activities of this committee for 1987 are described.

The major portion of this report is a review of current monitoring and research activities in the lower Fraser River and Estuary. Questionnaires were sent to individuals actively working in the area. The information obtained is presented in cross referenced tables describing general study information, and the details of sediment, water chemistry, biota and bioassay studies. The material presented indicates no duplication of effort with respect to current studies.

ACKNOWLEDGEMENTS

The Committee gratefully acknowledges the leadership of Dr. W.E. Erlebach, who served as chairman from the committee's inception in May 1986 to September 1986. His ideas were instrumental in both the development of the terms of reference and the choice of direction taken by the Committee. We thank all of those who responded to the questionnaire. We also thank Mary Lou Haines and Lorna Rounds for word processing.

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1. INTRODUCTION

The Fraser River rises in the Rocky Mountains, drains an area of approximately 230,000 square kilometres, and flows 1400 kilometres to its outlet in the Strait of Georgia near Vancouver, British Columbia (Figure 1). At New Westminster, the Fraser River mainstem divides to form two major channels, the North Arm and Main Arm, which carry 15 and 85 percent of the river flow, respectively. The lower portion of the Fraser River is tidal, with flow reversal extending as far upstream as Mission during the winter period of low river discharge. During this low flow period, a salt water wedge from the Strait of Georgia can penetrate upstream as far as New Westminster. During high flow from May to July, a heavy concentration of suspended sediment is transported downstream, contributing to the aggradation of river channels and the delta-front.

The Fraser River estuary supports many activities which may compete for use of the aquatic environment. The salmon runs on the Fraser River are among the largest in the world, with major commercial catches of all five Pacific species, important native food fisheries, and a significant sports fishery. The Fraser River delta is also a major resting and feeding area for migratory birds on the Pacific flyway. The Fraser River estuary and delta support the many forms of aquatic life at lower trophic levels which the fish, birds, and other wildlife utilize as food. The estuary is also used extensively for recreation, including boating, sports fishing, bird-watching, hiking, and swimming in Boundary Bay.

The Fraser River estuary is a zone of urban and industrial activity, with effluents and landfill leachates discharged directly to the river (or indirectly through municipal outfalls). The lower Fraser River and the Outer Estuary receive municipal wastewater which has undergone primary treatment including seasonal chlorination and, at two of three major sewage treatment plants, dechlorination. In addition the estuary receives stormwater and combined sewer overflows

(periodic discharges of mixed untreated sewage and stormwater). The river is dredged frequently and is a major transportation corridor. Forest industry processing facilities with their associated activities of log transportation, storage, sorting, dumping and preservative treatment of finished products are located along the shoreline. The water of the Fraser River is also used by industry as process and cooling water. Additionally, intensive agricultural activities require water for irrigation and run-off produced contains pesticide and fertilizer residues.

These numerous and, in some cases, conflicting activities require that the water quality of the river be maintained or improved. The Fraser River Estuary Study (FRES) and the Fraser River Estuary Management Program (FREMP) were both initiated to address these concerns.

1.1 Fraser River Estuary Study

In 1977-78, the Canada/British Columbia FRES was established to develop a management plan for the estuary. As part of Phase I of the FRES, a Water Quality Work Group was established which published a summary report and 16 technical and ancillary reports on water quality. Conclusions were made on the general water quality of the river, control measures were recommended, and recommendations were made for water quality monitoring.

Phase II of the FRES (1979-82) focussed on the development of a proposed management program for the Fraser River estuary. As part of Phase II, a federal/provincial committee was formed, which designed a monitoring program titled: Fraser River Estuary Monitoring, A Recommended Approach. Concurrent to this process, the B.C. Ministry of Environment and Parks developed provisional water quality objectives in reports titled: Fraser-Delta Area, Fraser River Sub-basin from Kanaka Creek to the Mouth, Water Quality Assessment and Objectives, and Boundary Bay and its Tributaries, Water Quality Assessment and Objectives.

1.2 Fraser River Estuary Management Program (FREMP)

The Phase II Fraser River Study Report: A Living River by the Door proposed a management program for the Fraser River Estuary. A review committee obtained public and government input to the approach and prepared the report titled: An Implementation Strategy for the Fraser River Estuary Management Program. This report formed the basis for the signing of a federal/provincial agreement on October 10, 1985, initiating the Fraser River Estuary Management Program.

The Management Program builds upon past achievements under the FRES, through adoption of common objectives and coordination of activities among agencies. One of the major goals of the Management Program is to "maintain ambient water quality levels in the Fraser River, outer estuary, and Boundary and Semiahmoo Bays that will ensure the preservation of fisheries and wildlife and, where suitable provide for water contact recreation" (1). The estuary is defined by the Management Program to include the land and water outside the boundary of the dykes (wetted side), between Kanaka Creek and the outlet of Pitt Lake in the east, the seaward limit of Sturgeon and Roberts Banks to the west, Point Grey to the north and the international boundary to the south, including Boundary and Semiahmoo Bays.

A major objective of FREMP is to improve decisions by having them made within an estuary-wide context and by providing all agencies with an opportunity to participate. Although it would be convenient to identify a single management plan, the existing complexity of jurisdictions and relationships among agencies has resulted in the linking of several plans and activity programs, each under the jurisdiction of an appropriate lead agency and all overseen by the Management Executive (Figure 2).

The Management Committee Executive is responsible for organization and administration. It establishes the distribution of funds

authorized under the federal provincial agreement, maintains a Secretariat Office in New Westminster, develops interagency committee initiatives, develops and approves terms of reference for activity programs, sets program priorities, and oversees the distribution of information to the public.

Eight major activities in the estuary have been identified which involve more than one level of government and hence require coordinated management. Activity Program Work Groups comprised of agency representatives and user groups will be examining these activities and developing guidelines on how they should be managed. The work groups include Log Management, Waste Management, Emergency Management, Habitat Management, Recreation Management, Port and Industrial Development, Navigation and Dredging, and Dyking and Drainage. Guidelines for preparing each of these Activity Programs were proposed in the report: An Implementation Strategy for the Fraser River Estuary Management Program. Specific terms of reference will be developed by each of the Work Groups.

In order to improve current approaches to water quality management of the estuary and the review of projects, the Management Committee established two key Committees: The Standing Committee on the Fraser River Estuary Water Quality Plan (discussed in Section 1.4) and The Environmental Review Committee.

1.3 Environmental Review Committee

The Fraser River Estuary Management Program is committed to developing a system that provides thorough and efficient review of proposed projects and activities in the estuary. A coordinated project review process was established in January 1986 to achieve this goal. The Environmental Review Committee, with members from Environment Canada, Department of Fisheries and Oceans, and Ministry of Environment and Parks, is responsible for reviewing comments from the various environmental agencies. It determines the level of environmental review that is required, and provides

a designated Lead Agency with a coordinated environmental response based on review agency comments.

1.4 Standing Committee on the Fraser River Estuary Water Quality Plan

Through FREMP a Standing Committee on the Fraser River Estuary Water Quality Plan has been formed, with three provincial and three federal representatives, and one representative from the Greater Vancouver Regional District. The purpose of the committee is to develop a plan which will include ambient water quality objectives for the study area, a coordinated monitoring program and documentation of an acceptable arrangement for enforcement. The provisional water quality objectives and the federal-provincial committee report Fraser River Estuary Monitoring, A Recommended Approach will be the starting point for a Water Quality Plan, which will be flexible and subject to adjustment. It will describe a phased process for establishing more definitive water quality objectives based on an analysis of monitoring results and information received from enforcement activities. The overall purpose of this process is to maintain and, where possible, improve the environmental quality of the estuary.

The duties of the Standing Committee also include advising the Management Committee Executive on water quality, providing an annual Status Report on Water Quality and advising on procedures for public input and public information.

The Water Quality Standing Committee has several tasks for 1987 (Table 1). In January a meeting was held with public interest groups to define their requirements for a Water Quality Plan, and to discuss mechanisms for ongoing public involvement. In February, a workshop was held at which scientists currently working in the estuary discussed previous findings, reviewed current projects, and planned future studies. The results of this workshop will provide a major input to the annual Fraser River Estuary Status Report on Water Quality, a document which will provide an

overview of current environmental quality. By December 1987, the First Water Quality Plan will be developed. This plan will be revised and updated in future years, as required.

2. SUMMARY OF MONITORING AND RESEARCH ACTIVITIES

As a first step in the Standing Committee's mandate to develop water quality objectives and a coordinated monitoring program for the Water Quality Plan, questionnaires regarding current (1986-87) research and monitoring programs were sent to those who were actively working in the estuary. Tables 2 to 7 describe the results from these questionnaires.

Table 2 provides a cross reference to the subsequent tables. The entry number in the first column of Table 2 is common to the monitoring sites in Figure 1 and Tables 3 to 7. These tables contain information on specific projects, the project rationale, and the environmental compartments. For example, from Table 2 it can be determined that a total of 47 replies to the questionnaire were received. Twenty-four recent studies involved sediments, 29 involved water chemistry, 20 involved biota, and 8 used bioassays. The greatest number of entries were provided by agencies such as the Universities and Colleges (14), Environment Canada (8), Department of Fisheries and Oceans (6) and the B.C. Ministry of Environment and Parks (5).

Table 3 provides general information for each project, including project timing, descriptions of study areas, other involved parties, laboratories used, characteristics measured, data storage, committed resources, whether descriptions of modelling and pathways studies are available and whether publications are planned, pending or in press.

More specific information is provided in Tables 4 to 7 on sediments, water chemistry, biota, and bioassays, respectively. The information for each of these environmental compartments is summarized below.

2.1 Sediments (Table 4)

Eleven of the 24 entries for sediments (Table 4) contain information on suspended sediments, while 20 of the 24 entries describe studies of bed sediments. The bed sediments sampled furthest upstream were from Barnston Island, with suspended sediments collected as far upstream as Hope, Agassiz, and Mission. The most intensively studied areas are usually related to municipal sewage discharges. For example, bed sediments were collected adjacent to the proposed Iona Island sewage treatment plant outfall at 25 locations and at two control sites. Twenty sites adjacent to the Annacis Island sewage treatment plant outfall were also sampled.

2.2 Water Chemistry (Table 5)

To minimize the number of categories, sampling for bacteriology was included under the heading of water chemistry. Samples for bacteriological analysis were usually collected at the same time as those for chemical analysis.

Approximately 20 of the 29 water chemistry studies took place on the Fraser River itself. Others were conducted on Sturgeon and Roberts Banks, Boundary Bay, or tributaries. Many of the studies were related to direct discharges and their localized impacts (e.g. entries 1-5, 25, 27, 33-35).

The largest number of locations sampled for water chemistry are associated with monitoring the quality of bathing beaches (primarily for microbiological indicators of fecal pollution). The second largest number of sites studied are those associated with discharges from sewage treatment plants.

The emphasis of water chemistry monitoring has changed since the release of the FRES reports. The influence of salinity, tides and changing river discharge rates in the estuary makes sampling water chemistry in a representative manner difficult. More effort is

now being directed to examining levels of metals and organic contaminants in water, sediments, and biota than to measuring nutrients and major ions. Current water chemistry studies are often a component of long term projects which require the collection of water, sediments, and biota to indicate levels of particular substances in more than one environmental compartment.

2.3 Biota (Table 6)

A wide range of living organisms were sampled or studied. These include bacteria, macrophytes, zooplankton, phytoplankton, great blue herons and, in 13 of the 19 entries, fish. The emphasis of much of the biological sampling is to determine levels of organic contaminants in fish tissues. Other work is related to characterizing the aquatic habitat of various species. Most sampling for biota takes place on the Main Arm, in the vicinity of the Annacis Island sewage treatment plant outfall.

2.4 Bioassays (Table 7)

Information on bioassays used is contained in Table 7. The number of entries in this table is small since bioassays on effluents have generally not been included. Bioassays which were reported could be classified into three distinct categories: bioassays using effluents, behavioural assays, and bioassays using sediments.

2.5 Evaluation of Sampling Duplication

The questionnaire responses were examined to determine whether there was any duplication of effort, and no significant overlap was found.

If the Annacis Island area is selected as a test case, five groups are involved in the sampling of sediments at 20 sites (Table 4). However, one survey was conducted in November 1983, while a second began in 1985. A third, recommended in Fraser River Estuary Monitoring, A Recommended Approach is to be undertaken in

1987. The fourth survey was conducted in August 1986 and examined metals, chlorophenols and PCB's at 61 locations in the Main and North Arms. The fifth survey was concerned with metal values in sediments in the immediate area of four metal finishing plants on the North Arm. It does not appear that these sampling programs could have been coordinated efficiently, because of differences in timing and sampling locations. However, it is important to ensure that the results of these studies are shared among the participating agencies.

As was the case for sediments, there was no duplication of effort for water chemistry samples, which were collected for many different purposes. Each purpose can dictate particular sampling requirements such as the time of day or month for collection or the need for collection of other samples at the same time.

There is no apparent duplication among agencies in the collection of biota. This is because biota are generally more difficult to sample, and different organisms are being tested by different agencies.

2.6 Conclusions

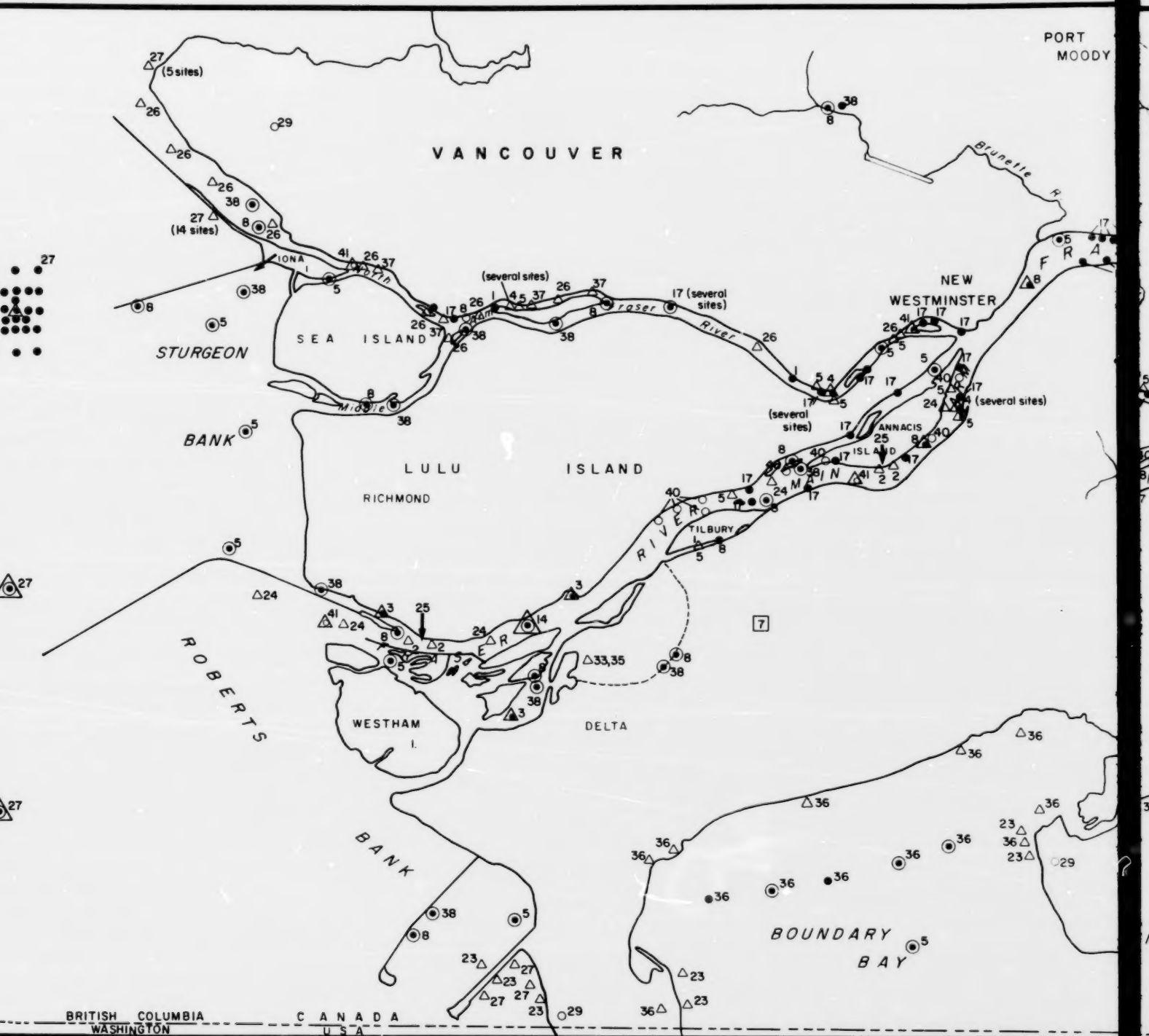
In conclusion, a large amount of effort is being applied to monitoring the Fraser River estuary. The measurement of conventional parameters such as bacteriological indicators has continued, while a growing emphasis is emerging on sampling for substances such as organic contaminants and metals. This survey does not show any duplication among agencies. The subject of research needs and deficiencies in knowledge will be addressed in the Water Quality Plan.

This report will be circulated to all those who provided input, as well as to other interested parties including the public. The tables will be updated annually.

3. LITERATURE CITED*

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3. Holms, G.B. and L.G. Swain. In preparation. Fraser-Delta Area, Boundary Bay and Tributaries, Water Quality Assessment and Objectives. Resource Quality Section, Water Management Branch, B.C. Ministry of Environment and Parks.
4. Swain, L.G. and G.B. Holms. 1985. Fraser-Delta Area, Fraser River Sub-basin from Kanaka Creek to the Mouth, Water Quality Assessment and Objectives. Resource Quality Section, Water Management Branch, B.C. Ministry of Environment. Victoria, 206 p.
5. Water Quality Work Group. 1979. Fraser River Estuary Study: Water Quality. Summary Report. Government of Canada and Province of British Columbia. 176 p.
6. Working Committee on Fraser River Estuary Monitoring. 1984. Fraser River Estuary Monitoring, A Recommended Approach. Government of Canada and Province of British Columbia. 43 p.

*These reports can be requested through the FREMP office, at 708 Clarkson Drive, New Westminster. Telephone: 525-1047.



LEGEND

- | | |
|----------------------|----------------------|
| • Sediment | ▲ Water and Sediment |
| △ Water | → Effluent |
| ○ Biota | △ Water and Biota |
| ⊙ Biota and Sediment | □ Groundwater |

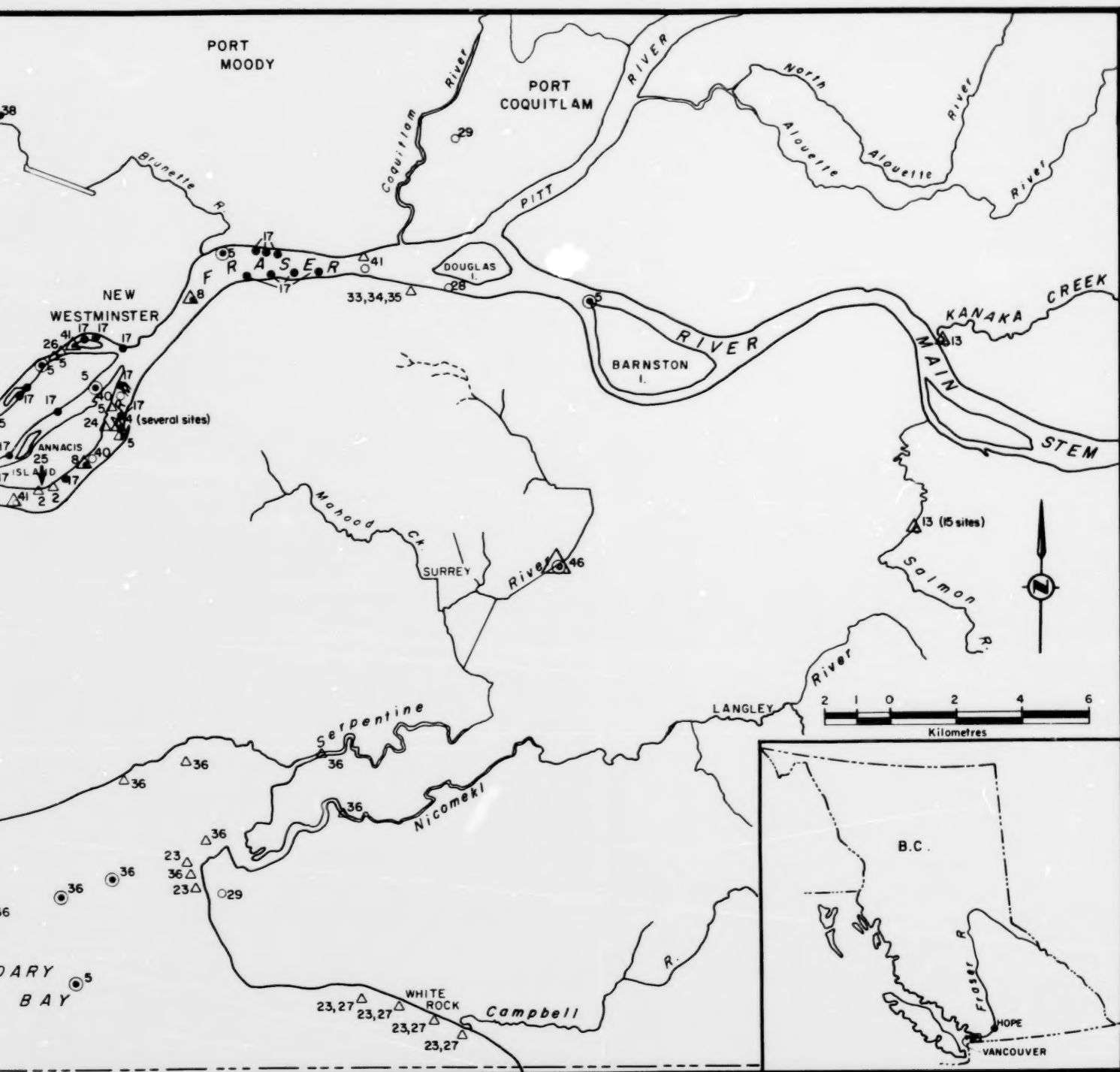


FIGURE 1

MONITORING IN THE

FRASER RIVER ESTUARY

(1986 QUESTIONNAIRE

INFORMATION)

FIGURE 2

FREMP COMMITTEES

Management Executive

Environment Canada
Ministry of Environment and Parks
Department of Fisheries and Oceans
Fraser River Harbour Commission
North Fraser Harbour Commission

Management Committee

STANDING COMMITTEES

- 1) Standing Committee on the Fraser River Estuary Water Quality Plan
- 2) Environmental Review Committee

ACTIVITY PROGRAM WORK GROUPS

- 1) Log Management
- 2) Waste Management
- 3) Emergency Management
- 4) Habitat Management
- 5) Recreation Management
- 6) Port and Industrial-Development
- 7) Navigation and Dredging
- 8) Dyking and Drainage

TABLE 1

Tasks for 1987 of the Standing Committee on the
Fraser River Estuary Water Quality Plan

<u>Task</u>	<u>Target Date</u>
Meeting with Representatives of Public Interest Groups	January, 1987
Fraser River Estuary Workshop	February, 1987
Report "Summary of Monitoring and Research Activities"	September, 1987
Fraser River Estuary Status Report	October, 1987
First Water Quality Plan	December, 1987

TABLE 2
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
1	B.C. Ministry of Environment and Parks	D. Walton L. Swain	584-8822 387-9518	North Arm Water Quality Sampling	To assess if water quality objectives are met in N. Arm when stormwater enters.		✓			✓
2	B.C. Ministry of Environment and Parks	B. Moore L. Swain	584-8822 387-9518	Annacis and Lulu STP IDZ Sampling	To assess if water quality objectives are met in Main Arm near sewage discharges.		✓			✓
3	B.C. Ministry of Environment and Parks	B. Moore	584-8822	Fraser River Fish Plant Survey	Determine impact of discharges on D.O. levels - examine chemistry of water & sediments.	✓	✓		✓	✓
4	B.C. Ministry of Environment and Parks	B. Moore	584-8822	Fraser River Metals Survey	Determine impact of operations on metals levels in water & sediments.	✓	✓		✓	✓
5	B.C. Ministry of Environment and Parks	D. Walton L. Swain	584-8822 387-9518	Fraser River Estuary Monitoring	To determine long-term trends in the Estuary.	1987/1988	1986/1987	1987/1988	1986/1987	✓
6	North Fraser Harbour Commission, Dept. of Fisheries & Oceans	G. Colquhoun O. Langer	273-1866	North Fraser Harbour Environmental Management Program	Develop a proactive and cooperative environmental management plan for port development/habitat conservation.			✓		✓
7	B.C. Ministry of Agriculture and Food B.C. MOEP	M. Driehuyzen N. Nagpal	576-2911 387-9507	Boundary Bay Water Control Project	Study all aspects of water control relative to agriculture or environment.		✓			✓
8	Environment Canada, Inland Waters/Lands	L. Churchilland T. Tuominen	666-8006 666-6038	Toxic Substances in Water, Sediments, and Biota of the Lower Fraser River and Estuary	To determine sampling methodology and levels of toxic organic contaminants.	1985 (bed) 1987-1988 (suspended)	✓	1985, 1986		✓

TABLE 2 (Continued)
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
9	Environment Canada, Inland Waters/Lands, National Water Research Institute	B.J. Dutka	(416) 336-4923	Microbiological Toxicity Screening Methods Evaluation and Testing	To develop a number of tests to identify degraded or degrading water bodies.	✓	✓		✓	✓
10	Institute of International Studies, Kwantlen College	B.A. Leach	588-4411	Disposal of Sewage Effluent in Burns Bog, Delta as a Means of Restoring Wetlands for Wildlife	To divert pollution from the river.					✓
11	UBC, Dept. of Botany	P.G. Harrison	228-4681 228-5621	Seagrass-Infaunal Interactions and the Dynamics of Soft Bottom Communities	To determine if relationship exists between reduced infaunal invertebrates and increased silt.	✓		✓		✓
12	UBC, Dept. of Soil Science, Westwater	H. Schreier	228-4898	Effects of Asbestos Fibres and Associated Trace Metals on Fish	Determine potential effect of asbestos and trace metals on fish.	✓	✓	✓		✓
13	UBC, Dept. of Zoology	J.D. McPhail	228-2368	Ecological Genetics of <i>G. aculeatus</i>	Not stated.		✓	✓		✓
14	UBC, Dept. of Zoology & Westwater	T.G. Northcote	228-3327	Interactive Ecology of Juvenile Salmonids in the Fraser River Estuary	To examine potentially competitive interactions in use of estuarine tidal channel habitat by juvenile salmonids.	✓	✓	✓		✓

TABLE 2 (Continued)
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
15	SFU, Biological Sciences	A.P. Farrell	291-3641	Ucrit as a Sublethal Toxicity Test in Salmonids	Ucrit (max. sustained swimming speed) represents optimal performance. Sublethal toxicity should reduce Ucrit.				✓	✓
16	Geological Survey of Canada	J.L. Luternauer	666-0788	Marine Delta Sedimentation	Sediment budget, delta front stability, development induced erosion, sediment dispersal patterns, sedimentation rates	✓				✓
17	Environment Canada, Environmental Protection	C. Garrett	666-3332	Monitoring of Fraser River Sediments, Water, and Fish for Chlorophenols, PCB's, Metals	To verify chlorophenol and metals levels from past surveys and to obtain data in new areas	✓	✓	✓		✓
18	Co-ordinating Committee, Canada-B.C. Water Quality Monitoring Agreement	R.J. Buchanan M. Clark P. Whitfield	387-9500 387-9947 666-8009	Canada - B.C. Monitoring Agreement	Joint Canada - B.C. long-term trend monitoring of surface water quality.		✓			✓
19	Inland Waters/Lands, Water Resources Branch	I.J. Stewart	666-3604	Determination of the Sediment Budget in the Lower Fraser River	To assist Transport Canada to estimate dredging requirements	✓				✓
20	SFU, Dept. of Geography, Remote Sensing Laboratory	A. Roberts	291-3365 291-4515 291-3321	Remote Sensing of the Fraser R. Sediment Plume & Littoral Environments	Calibrate airborne remote sensing systems for recording various aspects relating to water quality	✓	✓			✓

TABLE 2 (Continued)
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
21	Env. Can., Inland Waters/ Lands, Water Resources Branch	I.J. Stewart	666-3604	A Physical Areal Study of the Fraser River Delta	Hydrographic charts of delta area since 1932 examined to determine trends in advancement of delta					✓
22	Env. Can., Inland Waters/ Lands, Water Resources Branch	I.J. Stewart	666-3604	A Determination of the Flow Split in the Lower Fraser R. at Tri- furcation (North Arm)	To model flow distribution into North Arm and Annacis and Annie- ville Channels					✓
23	B.C. Ministry of Health	L. Copeland	594-0441	Bathing Beach Monitoring	To check fecal coliforms during summer at bathing beaches to ensure standards are met.	✓				✓
24	Greater Vancouver Regional District	R. Jones	432-6429	Receiving Water Quality, Main Arm Fraser River	To determine impacts from dis- charges from Annacis Is. and Lulu Is. STP's on Main Arm water quality	✓				✓
25	Greater Vancouver Regional District	R. Jones	432-6429	Sewage Treatment Plant Effluent Discharges	Monitor characteristics of dis- charges from Annacis Is. and Lulu Is. STP's	✓			✓	✓
26	Greater Vancouver Regional District	R. Jones	432-6429	Fraser R. North Arm Routine Monitoring	To assess possible pollution sources affecting Pt. Grey & English Bay Beaches	✓				✓
27	Greater Vancouver Regional District	R. Jones	432-6429	Environmental Monitoring, Iona Deep Sea Outfall Project	To assess the effect of the pro- posed discharge on the environ- ment in the proposed area	✓	✓	✓	✓	✓

TABLE 2 (Continued)
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
28	Canadian National Railways	J. Kavalalak	589-6573	Fisheries Assessment: Port Mann Intermodal Yard Site	Assess fish habitat and utilization in wetted areas which might be affected by CNR yard expansion			✓		✓
29	Canadian Wildlife Service	P. Whitehead	946-8546	Great Blue Heron Monitoring Program	Long-term monitoring of organochlorine levels in eggs			✓		✓
30	UBC and Water Survey of Canada	M. Church D. McLean	228-6282 228-3444	A Study of Processes Governing Channel Stability and Sedimentation along the Fraser River	Sediment budget model of Fraser R. based on 20 years data provides method to assess long-term behaviour along the river and a link between sedimentation and channel morphology	✓				✓
31	UBC, Dept. of Geological Science	R.M. Bustin	228-6179	Sedimentology and Geochemistry of Organic Matter - Fraser River Delta	Fraser Delta as a modern analogue to organic sedimentation; metal chelation in organics of Fraser-Delta	✓				✓
32	UBC	A.G. Lewis	228-3626	Iron Speciation and Bioavailability in the Lower Fraser River	Geochemical processes control potential importance of iron and other metal availability to organisms	✓	✓			✓
33	UBC, Environmental Engineering	J. Atwater	228-4694	Leachate Characterization and Generation as a Function of Field Conditions	To develop mass discharge models to facilitate treatment/management of leachate from municipal landfills		✓			✓
34	GVRD, District of Surrey	L. Haden	-	Port Mann Leachate Study	Determine leachate migration from landfill site		✓			✓
35	UBC, Environmental Engineering	J. Atwater	228-4694	Characterization of Trace Organics in Municipal Landfill Leachate	Determine significance of municipal landfill leachate as a source of organic contaminants		✓			✓

TABLE 2 (Continued)
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
36	Neptune Aquafarms International Ltd.	G.A. Vigers	986-4331	Initial Water Quality Testing For Aquaculture Purposes at Boundary Bay	Determine whether water quality meets standards for shellfish growing waters and to archive oyster tissues and sediments to measure metals and toxic organics	✓	✓	✓		✓
37	UBC, Dept. of Civil Engineering & Water Research Centre	K.J. Hall	228-6474	The Bioconcentration of Chlorophenols by Leeches and Their Use as <u>In-Situ</u> Biological Monitors	Chlorophenols are problems associated with wood preservatives. Leeches were to be assessed as <u>in-situ</u> monitors of biological availability.		✓			✓
38	UBC, Dept. of Civil Engineering & Water Research Centre	K.J. Hall	228-6474	Organic Contaminants in Fish Tissue & Sediments from the Fraser Estuary	Survey of identification & distribution of organic contaminants	✓		✓		✓
39	DFO, Institute of Ocean Sciences	T.S. Murty	556-8311	Numerical Model Studies of Fraser River Plume in the Strait of Georgia	Model Developed to Study the Effects of Tide, Wind, and Water Stratification on the Movement of Fraser River Plume in the Strait of Georgia					✓
40	DFO, Fisheries Research Branch	C.D. Levings	926-6747	Chinook Production & Residency	To get good data on chinook residency, migration, feeding, and food supplies			✓		✓
41	DFO, Fisheries Research Branch	I.K. Birtwell	926-5703	Lower Fraser River - Pollutant Effects	Examine effects of specific contaminants on fisheries resources, especially salmon		✓	✓	✓	✓
42	DFO, Fisheries Research Branch	J.S. Macdonald	926-9266	Residence and Biology of Non-Salmonids in the Lower Fraser River	To determine length of residence of non-salmonids used to monitor contaminant levels in estuarine habitats	✓		✓		✓

TABLE 2 (Continued)
PROJECT CROSS REFERENCE

ENTRY	SUPPORTING AGENCY	CONTACT	TELEPHONE	PROJECT TITLE	PROJECT RATIONALE	SEDIMENTS (Table 4)	WATER CHEMISTRY (Table 5)	BIOTA (Table 6)	BIOASSAYS (Table 7)	(OTHER DETAILS) (Table 3)
43	DFO, Institute of Ocean Sciences	W.J. Cretnay C.S. Wong	656-8412 656-8407	Fraser River Estuary Xenobiotic Phase Associations and Transport Study	Specific phase associations of organic xenobiotics and natural compounds in an estuarine system reflect their source, govern their dispersal, and are important in biological uptake	✓	✓			✓
44	DFO, Institute of Ocean Sciences	H. Rogers	224-1366	Pollution and Toxicology: Organic Chemistry Applied to Pollution Problems in the Fraser River Estuary	To study dispersion of toxic chemicals from the Annacis Island SIP in sediments, water, and fish	✓	✓	✓		✓
45	National Water Research Institute	J. Carey	(416) 385-8538	Fraser River Estuary: Contaminant Pathways	Chlorophenol pathways have been demonstrated in previous studies to be very site specific	✓	✓	✓		✓
46	Reid Crowther & Partners Waste Management	B. Duncan G. Gough	986-6181 584-8822	Serpentine River-Community Metabolism of river and sediments as it relates to agricultural nonpoint source pollution	Test new production/respiration chambers and examine agricultural runoff as it affects dissolved oxygen levels	✓	✓	✓		✓
47	Environment Canada, Environmental Protection	A. Colodey M. Pomeroy	666-2883 666-2937	Metals & Organic Contaminants in Sediments and Biota of Sturgeon and Roberts Banks	Study spatial distribution and uptake of selected contaminants	✓		✓		

TABLE 3
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
1	Oct. '86 - Mar. '87	3 sites N. Arm. N. bank at New Westminster, Byrne Rd., Oak St. Bridge	-	B.C. MOEP Environmental Laboratory	Cu(T), Pb(T), SS, Zn(T), CP's, SS, PH, NH, FC, DO (F)	SEAM	N/A	N/A	0.5	3 800	Yes
2	Dec. '86 - Mar. '87	U/S and D/S from STP's	-	B.C. MOEP Environmental Laboratory	T(F), DO(F), PH, FC, NH, Cu(T), Pb(T), Zn(T), CP's	Files	N/A	N/A	0.5		Yes
3	Aug. '86 - Spring '87	Immediate area around Ocean Fish- eries, Long Beach Shellfish, B.C. Packers	-	B.C. MOEP Environmental Laboratory	BOD, COD, TOC, SS, ash	Files	N/A	N/A	1	5 100	Yes
4	April '86- Jan. '87	Immediate area of metal finishing operations (Titan, Tree Island, Noranda, Western Canada)	-	B.C. MOEP Environmental Laboratory	Metals	Files	N/A	N/A	1.75	12 800	Yes
5	April '86- March '91	Fraser River below Kanaka Creek, Sturgeon and Roberts Bank, Boundary Bay	EPS	B.C. MOEP Environmental Laboratory UBC, ASL, CanTest, EPS Aquatic Toxicology Lab	Metals Organics Nutrients Ions General Water Characteristics	SEAM Files	N/A	N/A	14	100 000	Yes
6	June - Oct. '86	NFRHC jurisdic- tional area, Poplar Is. to Pt. Grey, Sturgeon Bank (portion)		N/A	marsh areas	DFO and NFRHC	N/A	N/A	Unknown	Unknown	Yes

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
7	Year-round	Near Crescent Slough	B.C. Min. of Environment and Parks	B.C. MOEP Environmental Laboratory	pH, pesticides, Sp. Cond., Total and Ortho P., TKN, NH ₄ , NO ₃	SEAM	N/A	N/A	2	~\$16 000	Yes
8	1985-1986	Lower Fraser R. and estuary	EPS, Institute of Ocean Sciences	National Water Quality Lab, Burlington Water Survey Lab, New Westminster. Water Quality Lab, North Vancouver.	chlorinated phenols, PCB's, PAH's, particle size, organic C, moisture content, Pb, Hg, Cd, Ni, Zn, Cu, Cr, lipid content	Data Sheets	N/A	N/A	-	-	3 planned - one on '85 survey, one for poster session and final report
9	June 1986	40 locations along Fraser River	WQB	Microbiological Laboratories, Burlington	Microbiological, biochemical and bioassay tests	?	N/A	N/A	-	-	Yes
10	1972- ?	Burns Bog	N/A	N/A	-	Files	N/A	N/A	-	-	Information Booklets (Douglas/Kwantlen Colleges)
11	1986-1989	Southern Roberts Bank, Intercauseway Area	N/A	N/A	Grain Size, Infaunal density	Files	N/A	N/A	5(86/87) 6(87/88) 6(88/89)	25 000 in each of 86/87, 87/88, 88/89	In Press (Estuarine, Coastal and Shelf Science)
12	1984-1986	Sumas River	N/A	Dept. of Soil Science, UBC, B.C. MOEP Environmental Laboratory/B.C. Research	Ni, Cr, Co, Mn, Cu, Zn	?	N/A	N/A	1(86/87) 4(87/88)	3000(86/87) 10 000 (87/88)	In Prep.

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
13	1983- ?	Salmon River and Kanaka Cr.	N/A	N/A	pH, DO, T, Sp. Cond., Morphology, biochemistry	Field Books	N/A	N/A	?	35 000 in each of '86/87 and 87/88	?
14	1987-1989	Tidal marshes of Ladner Marsh, Woodward Is.	N/A	T.G. Northcoote	Turbidity, SS, T, Sp. Cond., DO, Salinity	Field Books, Computer	N/A	N/A	3(86/87)	8 000 (86/87)	2 from lab experiments 1 from '86 field/lab session, others to follow
15	1987- ?	Salmonid Farms	N/A	N/A	Maximum Sustained Swimming Speed	?	N/A	N/A	-	-	-
16	1979- ?	Fraser-Delta Forshore Slope	Dept. of Geog., U. of Guelph; SFU; W. Wash. Univ.; Can. Hydrographic Service		Grain Size, organic content, metallic ions, sediment structures, bedforms, erosion rate, sedimentation rate	Computer Files	✓	✓	8	70 000	Planned & In Press
17	Aug. 1986	Main Stem, Main Arm, N. Arm	N/A	EPS/DFO, West Vancouver	PCB's, CP's, metals (ICAP), Cd, Pb, Hg	Paper (Computer in future)	N/A	N/A	1.5	5 000	Planned (In draft form)

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
18	Oct. 85 - ?	Fraser R. at Hope	N/A	B.C. MOEP Environmental Laboratory; IW/L, North Vancouver; IW/L, Burlington	Diss. Solids, SS, NH ₄ ; Diss. ortho, total & total diss. P., diss. & total Al, Cd, Cr, Cu, Fe, Mn, Pb, Zn, total Hg, phenol, FC, Temp (F), pH, turbidi- ty, color, Sp. Cond., Alk (pheno- and total), hard- ness, Ca, Mg, K, Na, Cl (diss), SO ₄ , Tot. diss. N, NO ₃ /NO ₂ , Silica, As, Se, F	NAQUADAT, ORACLE, SEAM	N/A	N/A	-	-	Planned circa 1990
19	July '86 - ?	Fraser R. from Pt. Mann to drop off of the delta	-	New West- minster Sedi- ment Survey Lab	Suspended Sedi- ment Concentra- tion, particle size	Files, Computer	N/A	N/A	-	-	Unofficial Report Form
20	'85 - '87	Mouth of the Fraser R. in the Strait of Georgia	Env. Can., Geologi- cal Sur- vey of Canada	-	Susp. Sediments, fecal coliforms	Digital and Photo- graphic	N/A	N/A	4(86/87) 4(87/88)	50 000 (86/87) 50 000 (87/88)	Published
21	July '86 - Jan. '87	Fraser Delta from Pt. Grey to Pt. Roberts	Geologi- cal Sur- vey of Can.	-	-	-	N/A	N/A	-	-	Planned
22	July '86 - Jan. '87	Fraser R. from Pt. Mann to trifurca- tion	WP & M, Ottawa	-	Discharge	-	N/A	N/A	-	-	-

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
23	Ongoing	Senlahmoo Bay, Crescent Beach, Centennial Beach, Boundary Bay Beach, Tsawwassen Beach, Ferry Causeway	-	Provincial Health Laboratory	Fecal Coliforms	Files	N/A	N/A	-	-	-
24	Ongoing	Five Sites on Main Arm	-	GVRD Lab	T, DO, FC, Total & S.S., Cl, Na, Ca, Cu(D), Pb(D), Zn(D), Cd(D), Cr(D), Fe(D), residual chlorine	GVRD Files	N/A	N/A	-	-	Printed Bimonthly Summaries
25	Ongoing	Main Arm, Fraser R.	-	GVRD Lab, Beak Assoc. Consulting Ltd.	SS, COD, Sp. Cond., T, D.O., pH, BOD, MBAS, FC, O & G, Phenol, toxicity, TKN, NH ₃ , NO ₂ /NO, T.P., Al, As, Cd, Cr, Cu, Fe(D), Pb, Mn, Hg, Mo, Ni, Zn, B, SO ₂ (D)	Files	N/A	N/A	-	-	Printed Monthly Reports and Annual Summaries
26	Ongoing	North Arm, Fraser River	-	GVRD Lab	T, D.O., F.C., Sp. Cond./Salinity	Files	N/A	N/A	-	-	Printed Biweekly Reports & Annual Summary
27	1986	Sturgeon & Roberts Banks, Iona Beach, Pt. Grey & English Bay Beaches	-	EVS Consultants, ASL, GVRD	see following tables	Files, Computer File	N/A	N/A	-	-	Interim (Nov'86) Final (Feb'87)
28	Indefinite	South Shore, Fraser R. near Douglas Is.	N/A	N/A	Fish populations, habitat descriptions	Two Summary Reports	N/A	N/A	<0.5	<5000	Summary Reports (1984-1986)

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
29	1976 - Present	Heron Colony, UBC. Others in 1977	N/A	National Wildlife Research Laboratory, Ottawa	Persistent organochlorine residues (see Table 6)	CWS, NWRC Computer (Ottawa)	N/A	N/A	4	15 000	-
30	1982 - 1987	Mission - Agassiz (Phase 1) D/S Agassiz (Phase 2)	N/A	N/A	Morphology	-	N/A	See Rationale Table 2	12	-	Yes
31	1980 - ?	D/S Barnston Is.	N/A	?	Organic chemistry, major & minor trace elements, sulphur, types of organics	-	N/A	N/A	-	-	Yes
32	1988 - 1990	Main Arm, D/S Tilbury Slough	Dept. of Geology or Oceanography	-	Iron Speciation	Tape, Disc	N/A	Mixing Experiment	12 (88/89 & 89/90)	80 000 (88/89 & 89/90)	Planned
33	1982 - ?	Burns Bog, Port Mann, Premier Landfill	N/A	Environmental Engineering, UBC	NH ₃ , COD, Total Solids, Sp. Cond.	hard copy, field & lab notes	N/A	N/A	3 per year in next 5 years	6 000 (86/87 to 88/89) 6 500 (89/90 & 90/91)	Yes
34	Oct '86 - Jan '87	Port Mann landfill	Dayton & Knight, Golder & Assoc.	?	?	?	N/A	N/A	-	-	-
35	1982 - ?	Burns Bog, Port Mann, Premier St.	N/A	Environmental Engineering, UBC	Purgeables to Full Purgeables, Base neutral & acid extract	Lab Notes	N/A	N/A	3 - 6 (86/87 to 88/89)	15 000 (86/87 to 88/89)	Planned 1986

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
36	Sept '86 - Apr. '87	Boundary Bay and Tributaries	EPS, EVS Consultants	EPS, EVS, ASL	Metals, organics, FC, DO, Salinity, T	Computer	N/A	N/A	0.25 (86/87) 1.0 (87/88)	3 000 (86/87) 10 000 (87/88)	Uncertain
37	June '84 - Oct. '86	North Arm, Fraser River	NWRI, Burlington	Environmental Engineering, GC/MS Lab, UBC	19 chlorophenol congeners, chlorophenol bioaccumulation	M.Sc. Thesis	Testing Bioavailability	N/A	-	-	C. Jacob, M.Sc. Thesis
38	Nov. '83 - March '86	Still Cr., North Arm, Main Arm, Sturgeon & Roberts Banks	IWD (Vanc.)	Environmental Engineering, GC/MS Lab, UBC, Water Quality Lab, IWD, N. Vancouver	44 organic contaminants, chlorinated hydrocarbons, phenoxy-acid herbicides	Reports	N/A	N/A	-	-	Hall, et al., 1984 Two submitted to IWD
39	Ongoing - June '87	Strait of Georgia	-	N/A	N/A	N/A	N/A	?	-	-	Nomograph
40	Aug. '86 - Dec. '87	Gravesend Reach (Anacis Island) & Wahleach Channel	G. Rosberg & Associates	N/A	DO, T, Salinity, Sp. Cond.	Field logs, VAX files, data reports	N/A	N/A	0.2 (86/87) 32 per year (87/88 to 89/90) 90/91	65 000 (86/87) 159 000 per year (87/88 to 89/90) 60 000 (90/91)	Pending
41	Ongoing	Main Stem, Main Arm, North Arm	-	DFO, West Vancouver	Chlorinated organics	VAX File	N/A	N/A	54 (86/87) 60 (87/88) 48 + yearly (88/89 to 90/91)	250 000 (86/87) 300 000 (87/88) 260 000 (88/89) 200 000 (89/90 & 90/91)	Pending

TABLE 3 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
GENERAL

ENTRY	PROJECT TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	OTHER INVOLVED PARTIES	LABORATORIES USED	CHARACTERISTICS MEASURED	DATA STORAGE	DESCRIPTION OF PATHWAYS STUDIES	DESCRIPTION OF MODELLING	RESOURCES		PUBLICATION (PLANNED, PENDING, IN PRESS)
									PERSON MONTHS	TOTAL BUDGET(\$)	
42	Spring '87 - Spring '88	Main Arm, Fraser R. between Annacis Is. and Tilbury Slough	G. Rosberg and Associates	DFO, West Vancouver	?	VAX disc & tape	N/A	N/A	1 (86/87)	16 000 (86/87)	Planned
43	Sept '88 - Sept. '90	?	Unknown	?	Phase associations, xenobiotics	VAX disc & tape	N/A	N/A	11 (87/88)	103 000 (87/88)	
44	1987 - 1991	Main Arm, Fraser River from Annacis Is. to Tilbury Slough	G. Rosberg and Associates	In-house	CP's, PAH's, pesticides, herbicides, resin acids, chlorinated organics	Computer Cards	N/A	N/A	12 per year (88/89 - 89/90)	90 000 per year (88/89 - 89/90)	Planned
45	Apr. '84 Mar. '88	Estuary from the trifurcation to the sea & Georgia St.	DFO, EPS, IW/L	National Water Research Institute	CP's, OC's, organic ID	-	N/A	N/A	12 (87/88 to 90/91)	120 000 (87/88)	Planned
46	Oct. '86 - Mar. '87	Serpentine R. at Fraser Hwy. and Harvey Rd. ditch	-	B.C. MOEP Environmental Laboratory	COD, % total volatile residue, TOC, NH ₃ , NO ₂ /NO ₃ , OP, Chl. a	Paper Copies	N/A	N/A	1	10 000	Planned report and journal article
47	1986 - ?	Intertidal flats, Roberts and Sturgeon Banks	-	EPS, DFO West Vancouver	Grain size, SVR, metals (ICAP), PCP, PCB, PAH	Data Sheets, Computer	N/A	N/A	1/yr	~10 000	In prep.

Symbols used in this Table:

- (1) CP's = chlorophenols
- (2) (D) = dissolved
- (3) (F) = field
- (4) O & G = oil and grease
- (5) Ortho P = orthophosphorus
- (6) Sp. Cond. = specific conductivity
- (7) T = temperature
- (8) (T) = total

TABLE 4
SUMMARY OF QUESTIONNAIRE INFORMATION:
SEDIMENTS

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	TYPE OF SAMPLE	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
3	Unknown	Unknown	Immediate Area around Ocean Fisheries, Long Beach Shellfish, B.C. Packers	Surface (Petite Ponar)	3/operation	1-9	Surface	BOD, COD, TOC	Petite Ponar
4	3 times	April '86 Sept. '86 Jan. '87	Immediate area around Titan, Tree Island, Noranda, Western Canada Steel	Surface (Petite Ponar)	34	1	Surface	Metals	Petite Ponar
5	Once	Spring '87	Fraser R. below Kanaka Cr.	Surface	6	10	Surface	Metals, CP's, PCB's	Unknown
8	Once/Site	Fall/Winter 1985, early 1986	Fraser River below Pitt R. (and Still Cr)	Surface- Ponar and Ekman Dredge	12 bed	5	Surface	Chlorinated phenols, PCB's, PAH's, particle size, org. C. content, moisture content	Ponar Ekman
8	Twice/year	July, December	Fraser River at New West- minster and near Annacis Island	Continuous flow centrifuge	2 suspended	1	2 m	Same as for bed sediments plus Pb, Hg, Cd, Ni, Zn, Cu	Continuous Flow Centrifuge
9	Once	June 1986	?	Surface Bed	40	1	Surface	FC/E.Coli, choles- terol, Clostridium perfringens, fecal streptococci, Klebsiella technique	Ekman Dredge

TABLE 4 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
SEDIMENTS

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	TYPE OF SAMPLE	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
11	Once/yr	1986, 1987, 1988	Roberts Bank, Intercausway Area	Surface Bed	?	2 - 4	0-10 cm	Grain Size	Core
12	Several	Peak Flow	Sumas River	Grab Surface Bed, Suspended	4	2	Various	Ni, Cr, Co, Mn, Cu, Zn	Grab, Pump
14	Weekly to Biweekly	Feb - July	Ladner Marshes, Woodward Is. Tidal Channels	Suspended	2 - 4	2 - 6	Surface, Near Bottom	Turbidity & SS	Dip or Pump
16	Mo/Yearly/ Decade	All year	Outer Channels Steveston- Sandheads/Delta Slope	Suspended and Bed	Adjacent to developments	Variable	to 1 m on flats; to 2 m on slope	Grain Size, organic content, metallic ions, sediment structures, bedforms erosion rate, sedi- mentation rate	Sounding, Photo- grammetry
17	Once	Aug. '86	Main Stem, Main Arm, N. Arm	Bed	61	1 - 3	Surface	PCB's, CP's, ICAP metals, Cd, Pb, Hg	Ponar
19	Mission- 6/yr Pt. Mann- 3/yr	Mission - all year Pt. Mann - May-July	Fraser R. at Mission & from Pt. Mann to delta	Suspended Bed	2	5	-	Suspended sediment concentration, particle size	Arnham Sampler (depth integrated bedload)
20	Coordinated with tide, season and over flights	-	Fraser R. mouth in Strait of Georgia	Suspended	5 - 20	10	?	Secchi Disc, suspended sediments	Integrated Vertical Water Sample

TABLE 4 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
SEDIMENTS

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	TYPE OF SAMPLE	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
27	Once	Feb-Apr '86	Sturgeon & Roberts Banks	Cores, Surface Grabs	27 (cores) 8 (grabs)	1 6	1 m Surface	For both: Methyl- naphthalenes, Methyl- phenanthrenes, PCB, DDE, nonyl & chloro- inated benzenes, phthalate esters. For Surface Grabs Only: As, Hg, Cu, Pb, Zn, Cd, Cr, FC, Tot. Vol. Res., Particle Size Distribution	Core, Grab
30	-	1982 - 1987	Fraser R. at Hope, Agassiz, Port Mann, Mission	Bed, Suspended	-	-	-	-	-
31	-	-	D/S Barnston Island, Boundary Bay	Bed	-20	-30	0-6 m	See Table 3	Cores
32	Dep. on Mixing Expt.	-	Main Arm D/S Tilbury Slough	0.4 µm and colloidal	-	-	-	Iron Speciation	Many
36	Semi-annual	-	Boundary Bay	Suspended	5	3	1.5-2.5 m	Metals, Organics	Mud Snapper Grab Sampler
38	Once	Nov. '83	Still Cr. North & Main Arms, Sturgeon & Roberts Banks	Bed	10	5	Surface	44 organic contamin- ants, chlorinated hydrocarbons, phenoxyacid herbi- cides	Ponar Dredge
42	Monthly	April - Sept. 87	Main Arm of Fraser and Roberts Bank	Bed	8	5-10	Unknown	?	Benthic Grab

TABLE 4 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
SEDIMENTS

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	TYPE OF SAMPLE	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
43	4/year	Oct., Jan., Apr., July	?	Suspended	6	16	Mid Water Column	Phase associations, organic xenobiotics	Centrifuge, Filtration, Ultrafiltration
44	?	?	Main Arm, Fraser R. from Annacis Is. to Tilbury Slough	Suspended and Bed	6	5	?	CP's, PAH's, pesti- cides, herbicides	Continuous Water Sampler Filter and Benthic Grab
45	Occasional	Sept (Susp.) July, Sept., Nov. (Bed)	Fraser R. from trifurcation to sea	Suspended Bed	Many	?	?	CP's, OC's, organic ID	Centrifuge, Cores, Grab
46	Irregular, Timed to First Flush Event	Oct. 14, 15 Nov. 18	Serpentine R.	Bed	2	=3	0.5 m	COD, % total volatile residue	Grabs, P/R chambers measure in- situ O ₂ demand
47	2/year	Jan. (pre- freshet) June (post- freshet)	Roberts/ Sturgeon Banks	Surface	10 (max)	1	Surface	Particle size, SVR, metals (ICAP), PCP, PCB, PAH	Grab

SYMBOLS USED IN THIS TABLE:

CP's = chlorophenols
Tot. Vol. Res. = total volatile residue

TABLE 5
SUMMARY OF QUESTIONNAIRE INFORMATION:
WATER CHEMISTRY

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
1	6 times in Oct-Mar period	Variable	3 sites on N. bank at New Westminster, Byrne Rd, Oak St. Bridge	3	1	Surface	Cu(T), Pb(T), Zn(T), FC, CP's, SS, pH, NH ₃ , DO(F)	Samples collected - 5 m from shore
2	4 times in Dec-March period	Variable	2 sites at each STP, one U/S and one D/S	4	2	Surface and Depth	DO(F), pH, FC, NH ₃ , Cu(T), Pb(T), Zn(T), CP's, T(F)	From boat
3	Unknown	Late Fall '86 Winter '87	Three fish plants: U/S, D/S, IDZ (Ocean Fisheries, Long Beach Shellfish, B.C. Packers	3	1	Surface and Depth	BOD, COD, TOC, ash	From boat
4	4 times: April '86- Jan. '87	April '86 June '86 Sept. '86 Jan. '87	Four metal plants (Titan, Tree Island, Noranda, Western Canada Steel	34	2	Surface and 1 m from bottom	metals	From boat
5	3 times: May '86 - March '87	Variable	U/S and D/S from Discharges	6	3	Surface	Varies with Site	From boat and Shore
7	monthly (nutrients) 2-3/yr (pesticides)	Year-round	Near Crescent Slough	8	1	N/A	TKN, NH ₃ , NO ₃ , Total & ortho P, Sp. Cond., pH, pesticides	Shallow wells
8	Twice/year	July, December	New Westminster and Main Arm, Annacis Island	2	1	2 m	Chlorinated Phenols	Extracts from continuous flow centrifuges

TABLE 5 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
WATER CHEMISTRY

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
9	Once	June 1986	?	40	1	0.5 - 1.0 m	FC, E.Coli, Coliphage, Cholesterol, Closter- idium perfringens, fecal streptococci, Klebsiella	Grab (hand)
12	4 - 6	Yearly	Sumas R.	2	2	Surface	Cr, Co, Ni, Mn, Cu, Zn	Grab and Pump
13	Monthly	Yearly	Salmon R. and Kanaka Cr.	15	-	-	pH, T, DO, Sp. Cond.	In Situ
14	Weekly or Biweekly	Feb - July	Ladner Marshes & Woodward Is. Tidal Channels	2 - 4	2 - 6	Surface, Near Bottom	T, DO, Sp. Cond., Salinity	In Situ
17	Once	Aug. '86	Main Stem, Main Arm, N. Arm	58	1 - 2	6" below surface	CP's	Grab
18	Biweekly	Yearly	Fraser R. at Hope	1	1	Surface	See Table 3	Grab
20	-	Summer	Fraser R. at mouth	-	-	-	FC	Aerial work related to GVRD monitoring on overflows
23	Once/week	June-Aug.	see Table 2	12 And at Stormwater Outfalls if results at beaches are high	1	Surface	FC	Grab
24	Bimonthly	Yearly	Main Arm, Fraser R.	5	1	Surface	See Table 3	Surface grab, midstream

TABLE 5 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
WATER CHEMISTRY

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
25	Daily to monthly, dependent on characteristic	Yearly	Discharges, Annacis & Lulu STP's	2	1, effluent weir	N/A	See Table 3	Grab or Composite, Dependent on characteristic
26	Biweekly	May - Sept.	N. Arm, Fraser R.	11	1	Surface	T, FC, DO, Sp. Cond./ Salinity	Surface Grab
27	Twice	Feb - Apr, June	Sturgeon Bank	3: one at centre of grid, one at each of reference sites	3	0.5, mid depth, 5 m from bottom	FC, DO, Sp. Cond./ T./Density Profiles, T & D Cd, Cr, Cu, Pb, Zn, Hg, As, NH ₄ , NO ₃ , T & D P., Si, PCB, DDE, methylnaphthalenes (1,2,3), methylphen- antirenes (1,2,3), chlorinated benzenes, 2,3,4,5; 2,3,4,6; 2,3,5,6 TTCP, PCP, nonylphenols, dibutyl & diethylhexyl phthalate	Surface Grabs & Profiles at 1 m intervals
27	Monthly Weekly	Oct - Apr. May - Sept. (Iona Bch)	Iona Bch, Towers & Wreck Bch, English Bay	14 (Iona Bch)	1	Surface	T, DO, FC, Salinity	Surface Grabs
	Biweekly	May - Sept. (Iona Bch) May - Sept. (others)	5 (Towers & Wreck Beaches, Pt. Grey Beaches)	5 (Towers & Wreck Bch)				
27	Daily to monthly, Dependent on characteris- tic	Yearly	Iona Discharge	1	1	N/A	See Entry 25 (this table) plus GC/MS scan (qualitative) and organics (see Table 4)	?
32	Dep. on Mix- ing Expt.	-	Main Arm D/S Tilbury Slough	-	-	-	Iron Speciation	Many

TABLE 5 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
WATER CHEMISTRY

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
33	Weekly	-	Burns Bog, Port Mann, Premier St. Landfills	1	2 at Burns Bog; 1 at Port Mann; 2 at Premier St.	N/A	NH ₃ , COD, Sp. Cond., Total Solids	Grab
34	?	?	Port Mann landfill	?	?	?	?	?
35	Sporadic	Six samples since 1981	Burns Bog, Port Mann, Premier St. Landfills	3	?	?	See Table 3	Grab
36	Monthly	Oct - April	Boundary Bay	15	1	Surface	FC, DO, T, Salinity	Grabs
37	Every 2 hours	June-Oct. '84 Jan.-Oct. '85	North Arm, Fraser River	7 (grab) 1 (auto)	varies	Surface (grab), 1 m (auto)	19 chlorophenol congeners	Grabs & automated ISCO sampler
41	At time Fish Collected	April '86	Main Stem, Main Arm, North Arm, Fraser River	5	5	Surface	Chlorinated organics	Grabs
43	4/year	Oct., Jan., Apr., July	?	6	16	Mid Water Column	Organic xenobiotics	In Situ Trace Enhancement
44	?	August	Main Arm, Fraser R., from Annacis Is. to Tilbury Slough	5	1 x 2	Sub- surface	CP's, PAH's, pesticides, herbicides, resin acids, chlorinated organics	Automatic Samplers
45	?	July, Sept., Nov.	Fraser R. from trifurcation to Georgia St.	Many	?	?	CP's, general organics ID	Automatic Samplers, Surface Grabs

TABLE 5 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
WATER CHEMISTRY

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLES/ LOCATION	SAMPLE DEPTHS	CHARACTERISTICS MEASURED	SAMPLING METHODS USED
46	Irregular During First Flush Event	Oct. 14, 15, 28, 29 Nov. 18	Serpentine R.	2	=5	0.25 m	TOC, COD, NH ₃ , NO ₂ /NO ₃ , OP, CHL <u>a</u>	Grabs & Insitu measurements

SYMBOLS USED IN THIS TABLE:

CP's = chlorophenols, (F) = field, FC = fecal coliforms, Sp. Cond. = specific conductivity
T = temperature, (T) = total, TXN = total Kjeldahl nitrogen

TABLE 6
SUMMARY OF QUESTIONNAIRE INFORMATION:
BIOTA

ENTRY	FREQUENCY	TIMING	POP. STUDIES Y/N	LIFE CYCLES Y/N	BIO- ACCUMULATION Y/N	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SPECIES @ EACH LOCATION	TISSUES	CHARACTERISTICS	SAMPLING METHODS USED
5	1	Feb. '87	N	N	N	U/S and D/S reaches of each arm	6	Whatever benthos are found in sediments	Yes	PCB's, CP's, metals	Surface grab, sorting
5	1	1988	N	N	Y	U/S and D/S reaches of each arm	6	Whatever fish are found	Yes	PCB's, CP's, Metals	Gill nets, Beach seines?
6	1	June-Aug '86	Y	N	N	N. Fraser R. marshes (=50)	=50	Representative Plants Identified	None - Marshland Areas Estimated	Area	N/A
8	1	Fall/Winter '85, early '86	N	N	Y	Sturgeon/ Roberts Banks, Main and North Arm, Still Cr.	12	Starry Flounder Staghorn Sculpin Carp Brassy Minnow	Liver, Muscle, or Whole Fish (minnow)	length, wt., moisture con- tent, PCB's, chlorinated phenols, di- benzofurans, lipid content	Beach Seines, 1-1/2" & 2-1/2" gill nets
11	Variable	Summer ('86, '87, '88)	Y	N	N	Roberts Bank Intercauseway Area	Numerous	Densities of Infauna Callinassa californiensis	-	Density	Transects, quadrats (enumeration), digging
12	2	June '85/'86	N	N	Y	Sumas R. at Int. Bdy.	1	=100	tissues & whole of trout, Stickle- back, N. Squawfish sculpins, redds shiner, cutthroat trout, coho	Cu, Zn, Ni, Cs, Co, Mn	Electro- shock and nets
13	Monthly except bimonthly (Apr-July)	-	N	N	N	Salmon R. & Kanaka Cr.	15	Ecological genetics of stickleback populations	-	Morphology, biochemistry	Minnow traps

TABLE 6 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
BIOTA

ENTRY	FREQUENCY	TIMING	POP. STUDIES Y/N	LIFE CYCLES Y/N	BIO-ACCUMULATION Y/N	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SPECIES @ EACH LOCATION	TISSUES	CHARACTERISTICS	SAMPLING METHODS USED
14	Weekly - Biweekly	Feb - July	Y	N	N	Ladner Marsh & Woodward Is.	2 - 4	Zooplankton and zoobenthos density Pink, chum, chinook juveniles & some co-habiting fish species.	-	Density	Surface & near bottom zooplankton (-1.5-2 m) at near full tide level Zoobenthos: 6-8 core samples at near mid-channel mud substrate
17	Once	Aug. '86	N	N	Y	N. Arm near Mitchell Is.	5	Sculpin, flounder, stickleback, sucker, Dolly Varden	Whole	CP's PCB's	beach seine
27	Once	June-Aug '86	N	N	Y	N. of diffuser in predicted zone of impact	6	Pelagic fish, groundfish, invertebrates	Dorsal muscle, liver-gall bladder, leg meat (crabs), tail meat (shrimps), Whole (benthos)	See Table 4 For Both: and For Surface Grabs	Gill nets & surface grabs
28	Once in '83, '84, '86	Aug '83 June '84 July '86	Y	N	N	South shore of Fraser R. near Douglas Is.	4	Fish populations	-	Habitat description	beach seine, electro-shocking
29	-5 year cycle	April/May	N	N	Y	UBC Colony, Pt. Roberts, Crescent Bch, Coquitlam	-	Whole, fresh heron eggs	eggs	HCB, p,p'-DDE, p,p'-DDD, p,p'-DDT, PCB, -BHC, B-BHC, -BHC, oxychlorodane, transchlorodane, cis-chlorodane, heptachlor epoxide, dieldrin	Eggs broken into acetone rinsed glass jars, frozen, shipped

TABLE 6 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
BIOTA

ENTRY	FREQUENCY	TIMING	POP. STUDIES Y/N	LIFE CYCLES Y/N	BIO-ACCUMULATION Y/N	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SPECIES @ EACH LOCATION	TISSUES	CHARACTERISTICS	SAMPLING METHODS USED
36	Semi-annual	October and April	N	N	Y	Boundary Bay	3	Oysters	Whole	FC, organics, Cd, Cu, Pb, Zn, Hg	40-50 oysters to be sampled Oct '86 and Apr '87 for FC, tissues archived for metals & organics
37	Variable	June-Oct. '84 Jan.-Oct. '85	N	N	Y	North Arm, Fraser River	1	Leeches	Whole	Chlorophenols	Leeches left in bioassay containers in river for 1 week
38	Twice	Nov. '83 Sept. '85	N	N	Y	North & Main Arms, Sturgeon & Roberts Banks	9	Starry flounders (juveniles & adults)	Tissue	44 organic contaminants, chlorinated hydrocarbons, phenoxycid herbicides	Beach seine
40	Monthly	Aug. '86 - April '87	Y	Y	N	Gravesend Reach (Annacis Island) and Manleach Channel	15	Chinook	N/A	T. Salinity, Sp. Cond., DO	Beach seine
41	?	April '86, Spring 87/88	N	Y	Y	North Arm, Main Arm, Fraser River	5	Eulachons (86/87) starry flounder, chinooks (future)	carcasses, gonads, livers	Chlorinated organics plus morphometric statistics	Gillnets, beach seines (future?)
42	Monthly	April - Sept. '87	Y	N	Y	Main Arm and Roberts Bank	8	Prey species	?	?	Benthic grabs

TABLE 6 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
BIOTA

ENTRY	FREQUENCY	TIMING	POP. STUDIES Y/N	LIFE CYCLES Y/N	BIO-ACCUMULATION Y/N	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SPECIES @ EACH LOCATION	TISSUES	CHARACTERISTICS	SAMPLING METHODS USED
44	Monthly	87/88 - 88/89	N	N	Y	Main Arm, Fraser River from Annacis Is. to Tilbury Slough	6	Chinook	Livers, carcasses	CP's, PAH's, chlorinated organics	Beach seine
45	Occasional	Sept., July	N	N	Y	Fraser R. from trifurcation to Georgia St.	Many	Starry flounders, squawfish, sculpins	Liver, gall bladder, whole fish	CP's, OC's	Beach seine gill nets
46	Irregular	Oct./Nov.	Y	N	N	Serpentine R.	2	Bacteria, phytoplankton, zooplankton	-	Coarse Taxonomic Identification	-
47	2/year	Jan. (pre-freshet) June (post-freshet)	N	N	Y	Roberts/Sturgeon Banks	10 (max)	Invertebrates, clams	Whole	Size, species, PCP, PCB, PAH, metals (ICAP)	Surface grab

TABLE 7
SUMMARY OF QUESTIONNAIRE INFORMATION:
BIOASSAYS

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLING SITES/ LOCATION	LAB	SPECIES	TYPE			DESCRIPTION OF TECHNIQUE	REASON(S) FOR BIOASSAY
								FIELD, STATIC FLOW THROUGH	DURATION	LC50 LT50		
3	Unknown	Unknown	Sediments	Unknown	Unknown	B.C. MOEP Environmental Lab	Unknown	Unknown	Unknown	Unknown	Being developed	To determine impact of discharges on sediments
4	Unknown	Unknown	Sediments	Unknown	Unknown	B.C. MOEP Environmental Lab	Unknown	Unknown	Unknown	Unknown	Being developed	To determine impact of discharges on sediments
4	Unknown	Unknown	Water	1	1	B.C. MOEP Environmental Lab	Unknown	Unknown	Unknown	Unknown	In-situ	To determine impact in blind channel at Tree Is.
5	Unknown	As Required	Industrial Discharges	8	1	EPS, North Vancouver	Rainbow	Static	96 h	LC50	EPS Procedures	To determine cumulative effects of contaminants in effluents
9	Once	June 1986	?	40	1 (sediments & water)	Burlington		Microtox,	-	-	Beckman, Microtox & Dutka & Kwan (1981)	To determine if area is degraded
								SOS chromates geno toxicity ATP - tox	-	-	Fish et al. (1985)	
								algal assay	-	-	Xu & Dutka (1986)	
15	?	1987 - ?	Salmonid Farms	?	-	?	Salmo Sp. and Oncor- hynchus Sp.	Flow through	-	-	-	To determine if max. sus- tained swim- ming speed is reduced with sublethal toxicity

TABLE 7 (Continued)
SUMMARY OF QUESTIONNAIRE INFORMATION:
BIOASSAYS

ENTRY	FREQUENCY	TIMING	STUDY AREA (REFERENCED ON FIGURE 2)	NO. OF LOCATIONS	SAMPLING SITES/ LOCATION	LAB	SPECIES	TYPE			DESCRIPTION OF TECHNIQUE	REASON(S) FOR BIOASSAY
								FIELD, STATIC FLOW THROUGH	DURATION	LC50 LT50		
25	Monthly	Yearly	Annacis & Lulu STP effluents	2	1	Beak Consultants	Rainbow trout	Static	96h	LC50	BC MOE (1982)	Permit Monitoring Requirement
27	Monthly	Yearly	Iona STP	1	1	Beak Consultants	Rainbow trout	Static	96h	LC50	BC MOE (1982)	Permit Monitoring Requirement
41	Spring	1988	Annacis STP (in West Vancouver Lab)	Lab	-	DFO, West Vancouver	Juvenile chinook	-	-	-	Behavioural assays	